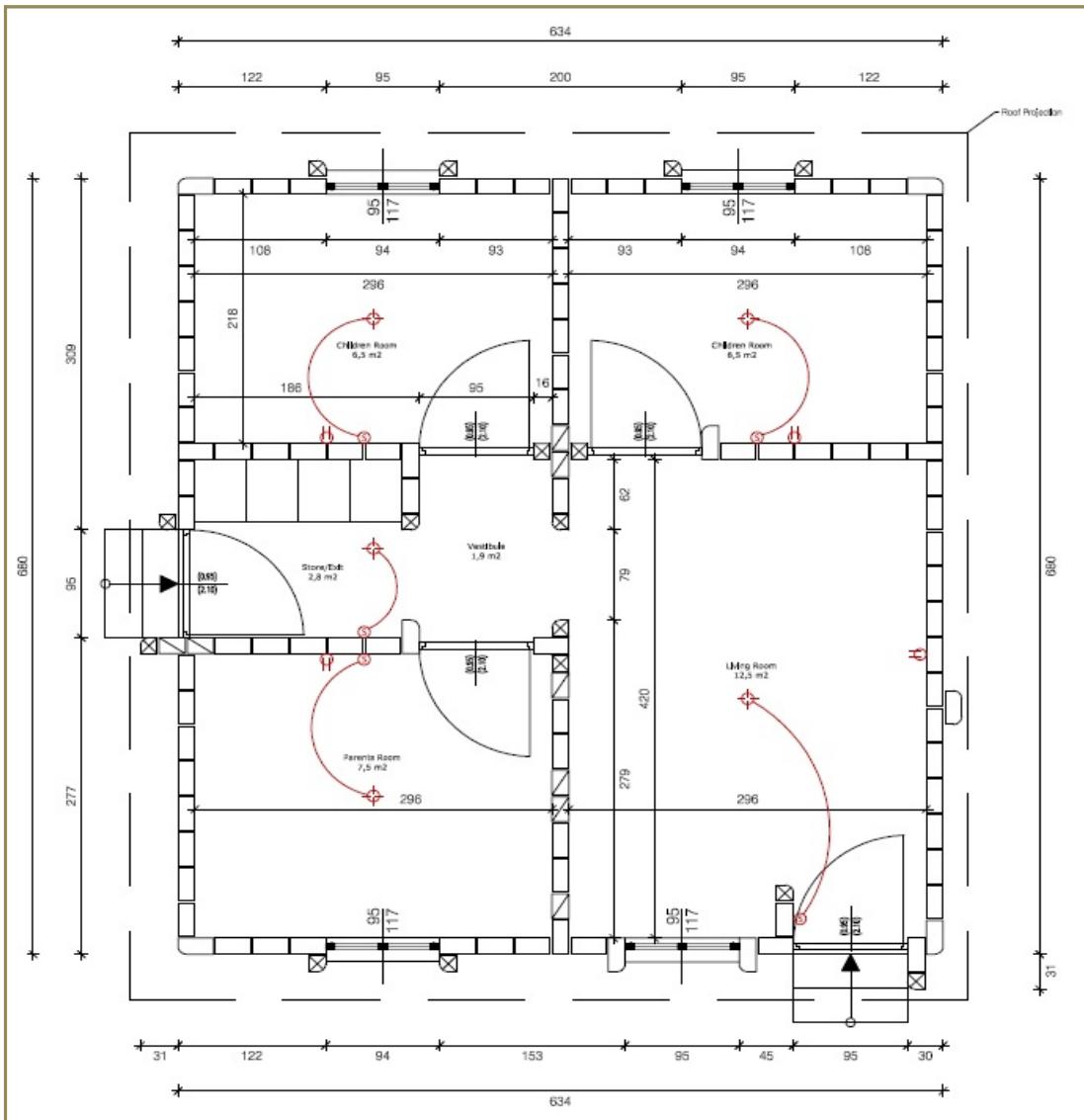


# PROECCO Program

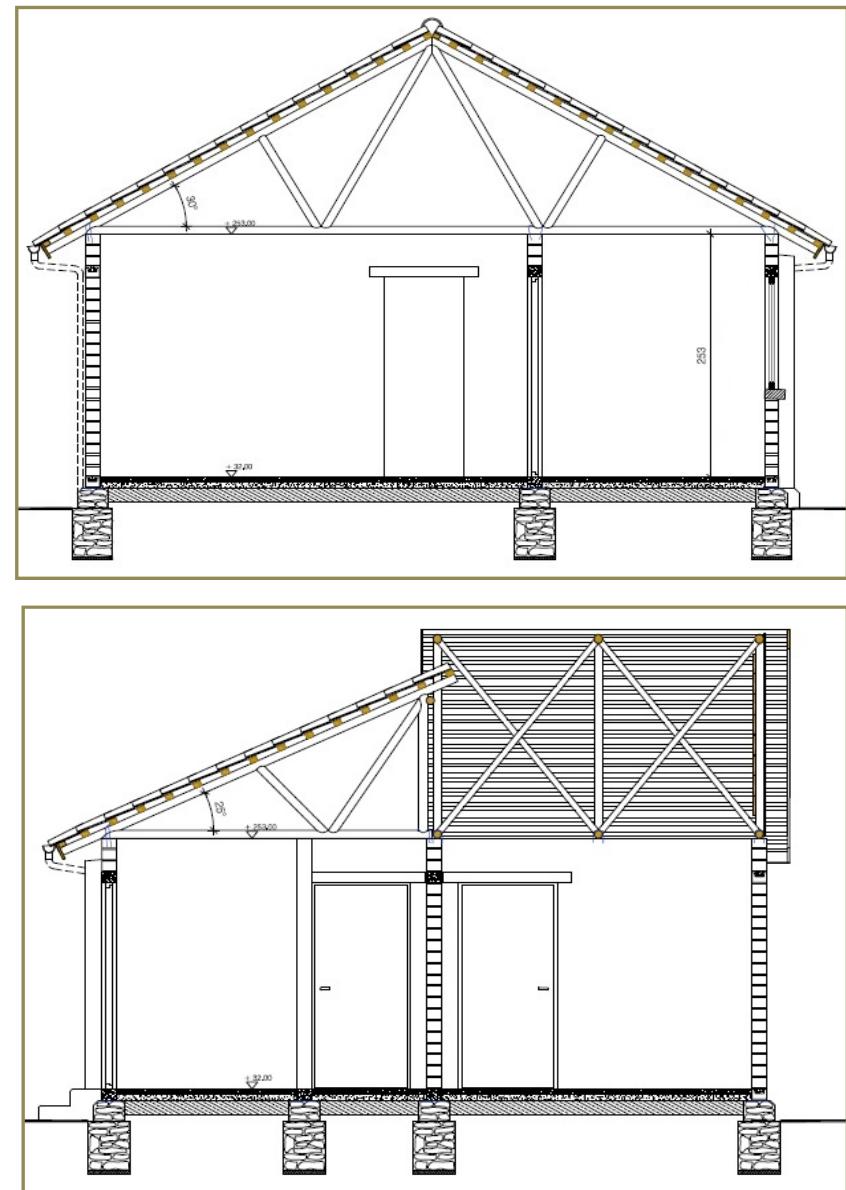
*Implementing a building with SCEB (Stabilized Compressed Earth Blocks) : Logbook*



## Ongoing Process : Technical Drawings



The aim of this pilot building made out of stabilized compressed earth blocks is to show a further technical option for family units with higher income.



Ongoing Process : Site Selection



The site was chosen in close cooperation with the authorities involved in the program.





SCEB Building : Early Stage

### Ongoing Process : Terracing

The steeply sloping of the site has imposed an important work of preliminary terracing.



## Ongoing Process : SCEB Production

After testing several types of soil a suitable option has been found not far from the site.  
The press used for the production is a Testaram



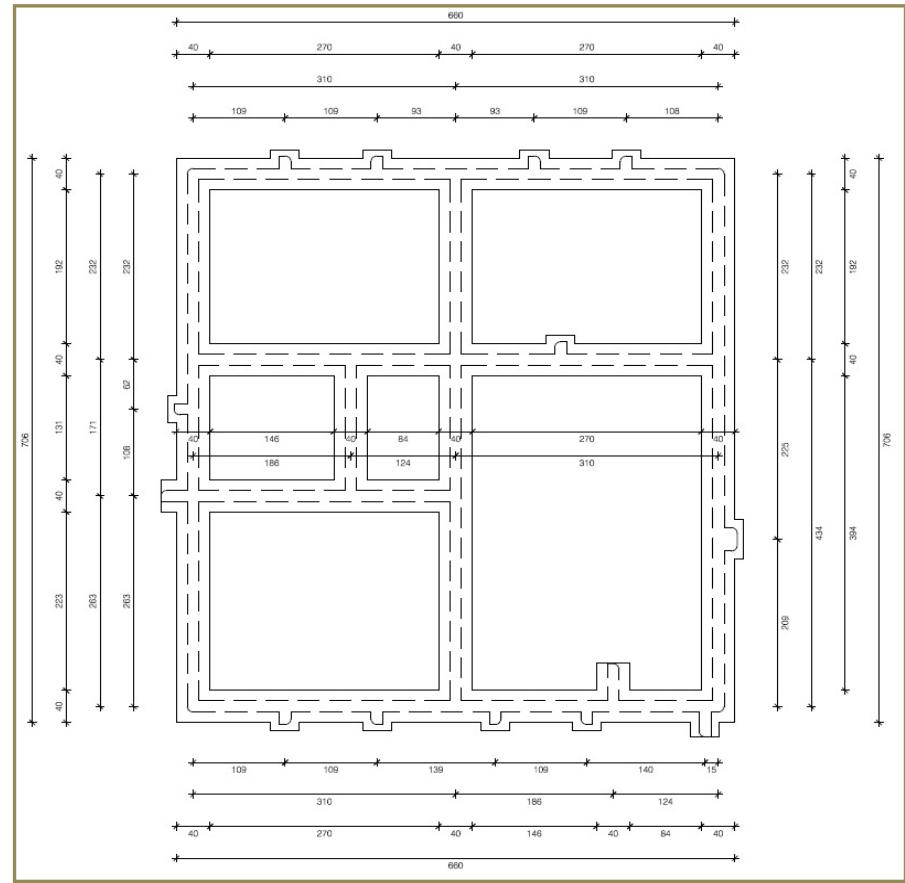


## Ongoing Process : Setting up

The position of the building is the result of compromise between the needs of future users and the several constraints of the site



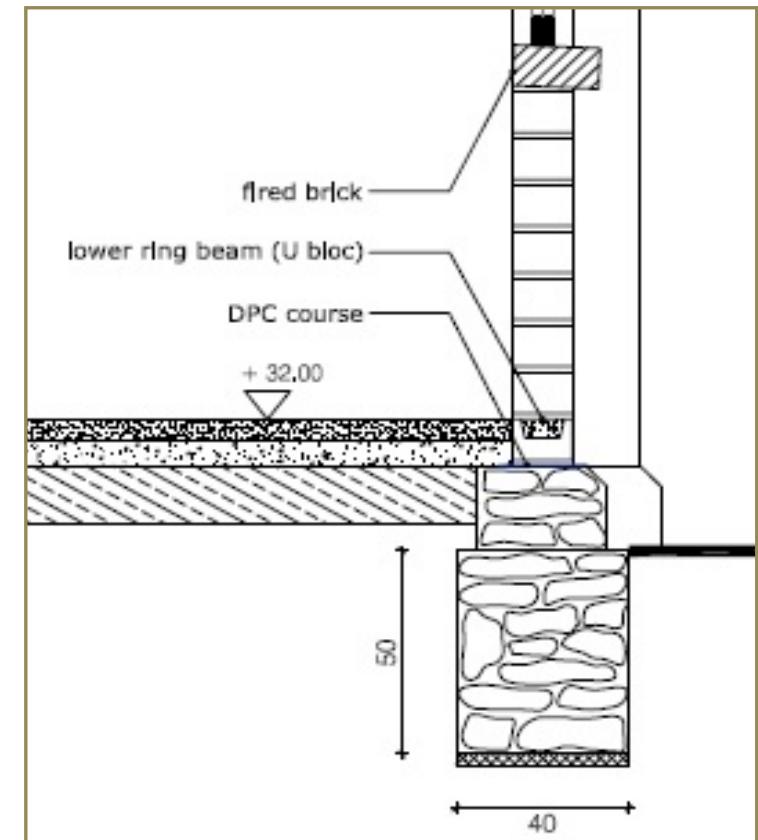
## Ongoing Process : Digging Trenches



The foundations trenches (see plan above) were 50 cm deep and 40 cm wide.



## Ongoing Process : Stone Foundation



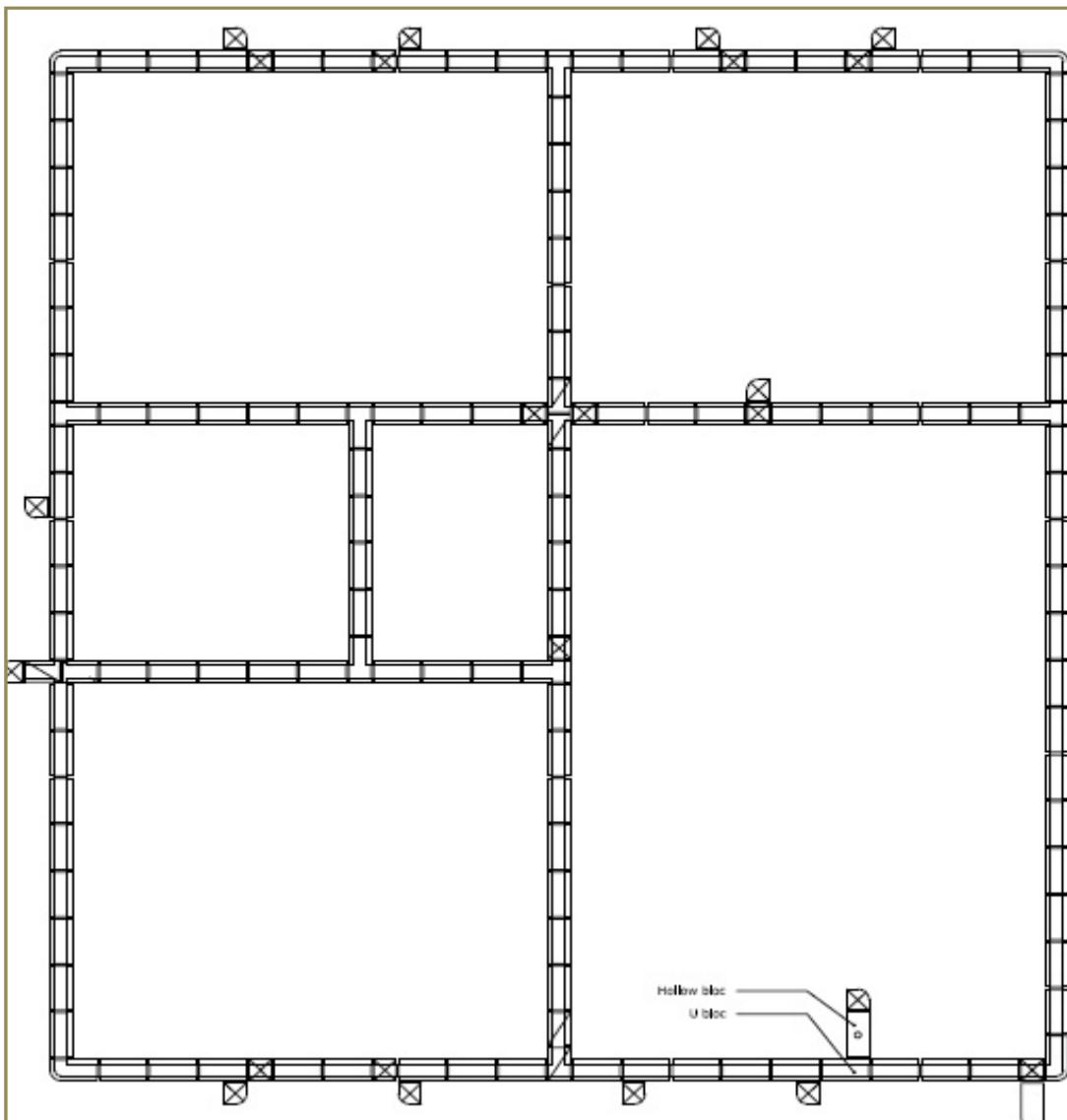
After laying 3 cm of lean concrete on the bottom of the trench ( $150\text{kg/m}^3$ ), stones are put in place with cement mortar.



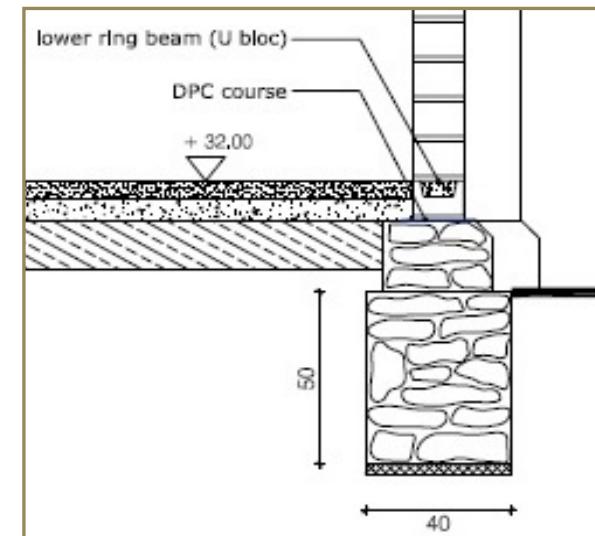
Ongoing Process : **Stone footings**



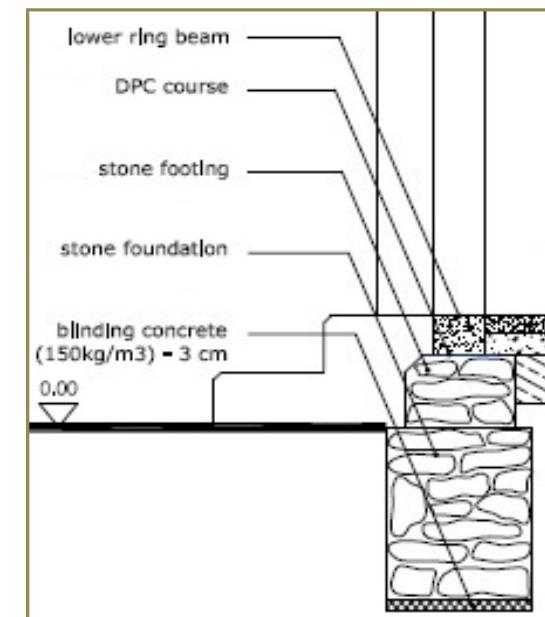
In order to protect the base of the walls from friction and water erosion, a 30 cm high stone-cement base has been foreseen. Great attention has been paid to prevent corners damages, to drain rain water away and to make a smooth and good looking external surface.



## Ongoing Process : Lower Ring Beam



The lower ring beam has been made out of U blocks filled with reinforced concrete (300kg/m<sup>3</sup>).



Ongoing Process : **Lower Ring Beam**



U blocks with reinforced concrete (300kg/m<sup>3</sup>)





### Ongoing Process : **Doorsteps**

To avoid bricks erosion over time, doorsteps are made out of concrete. This solution allow to keep continuity of the lower ring beam.





SCEB Building : Masonry Works

### Ongoing Process : DPC (*Damp Proof Course*)

To avoid water to rise into the wall by capillarity, a water proof barrier has been laid just on the lower ring beam.

Materials standing under the DPC must be water resistant.



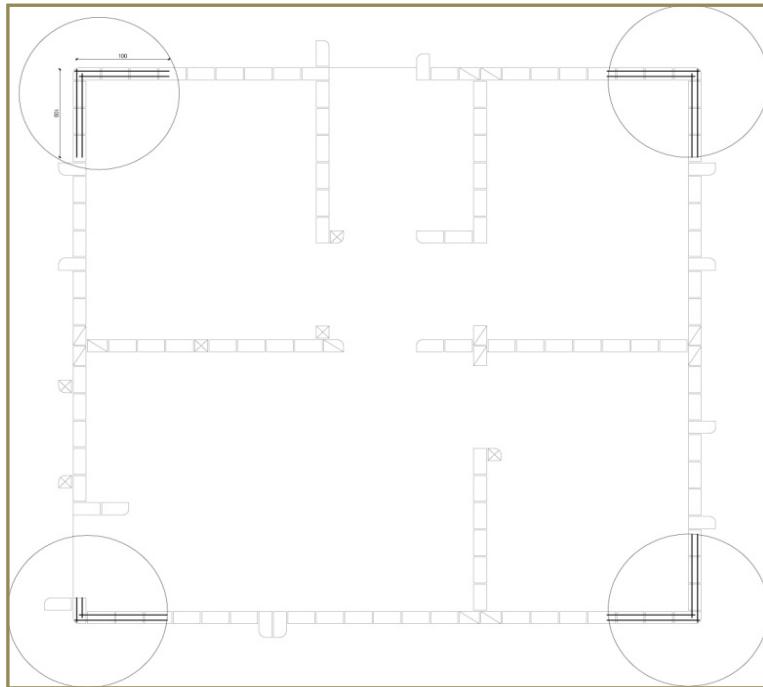
## Ongoing Process : Masonry



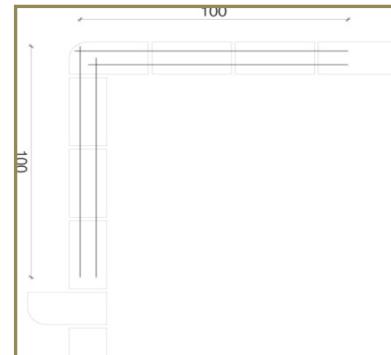
SCEB blocks are laid with soil-cement mortar (10% ratio).

To lay SCEB blocks needs much more attention and skills than needed for adobe masonry works.





## Ongoing Process : Masonry – Corner Reinforcements



To improve earthquake resistance, reinforcements have been foreseen in the four angles of the building, every four brick courses.

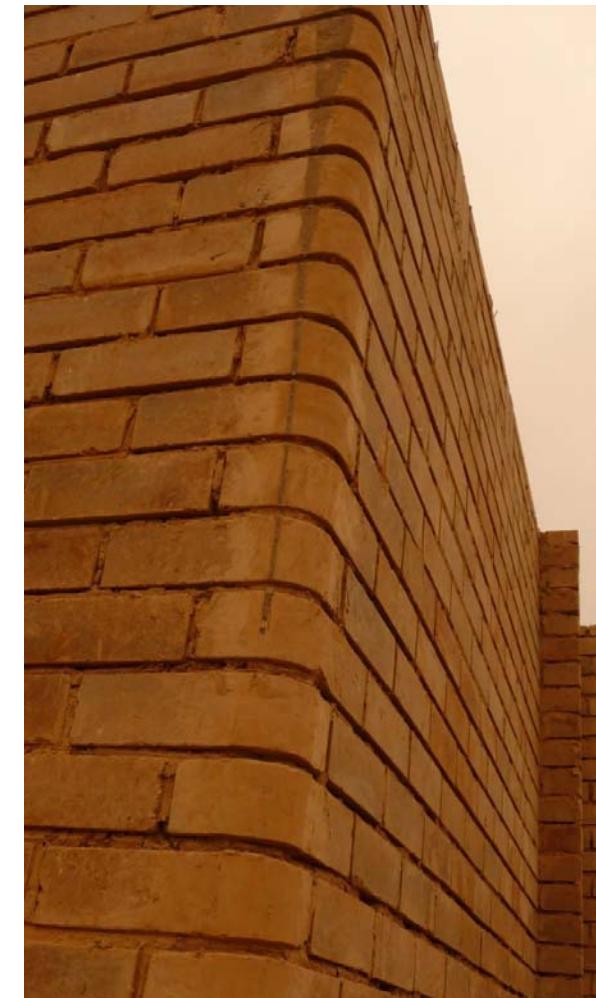


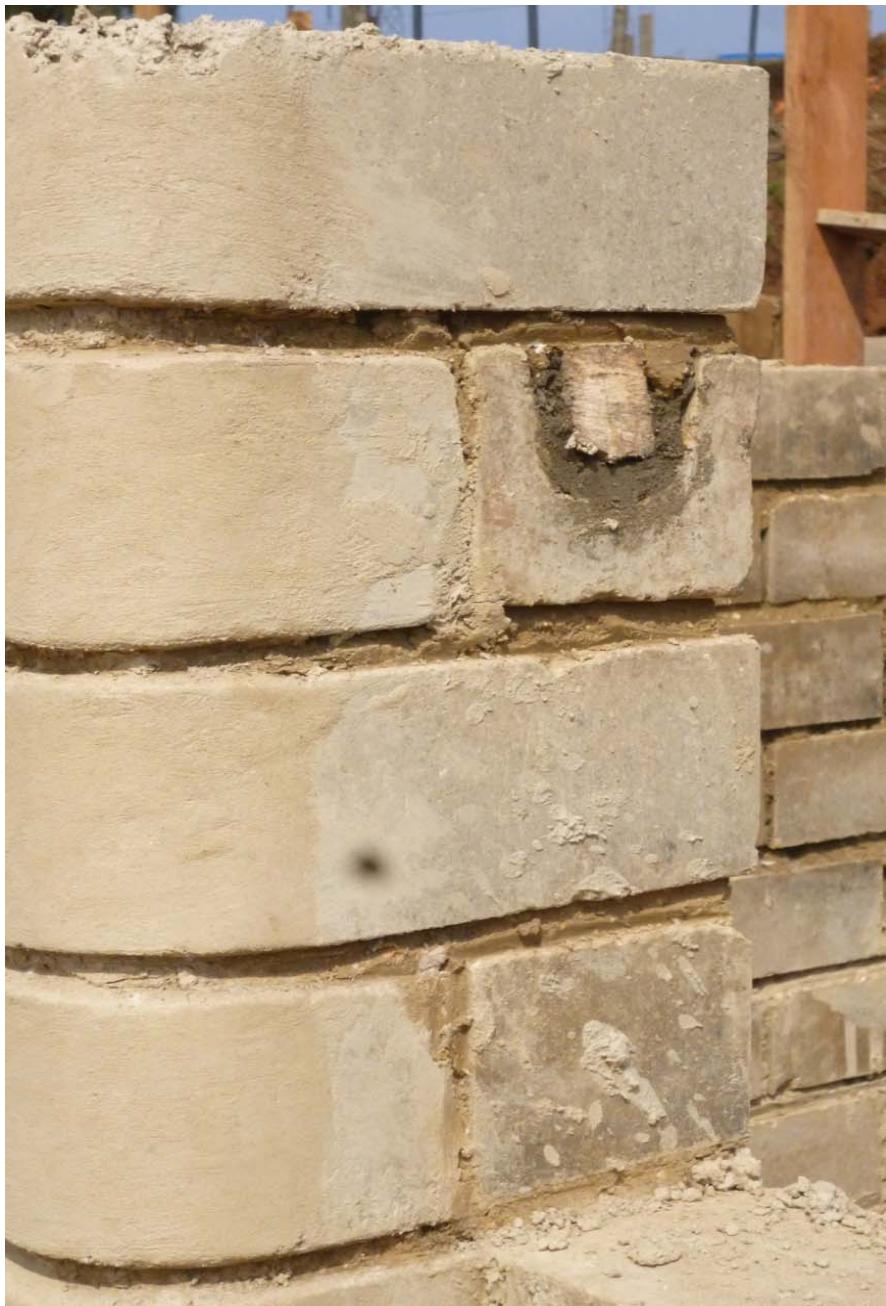


SCEB Building : Masonry Works

### Ongoing Process : Masonry – Corner Reinforcements

To improve corner resistance, rounded stabilized SCEB have been laid.





Ongoing Process :  
**Masonry – Doors and windows anchoring**



Some examples of windows and doors anchoring



- Window sills have been made out of fired bricks laid with lime-cement-sand mortar.
- Ventilations have been implemented on the top of the windows.

### Ongoing Process : Masonry – Details

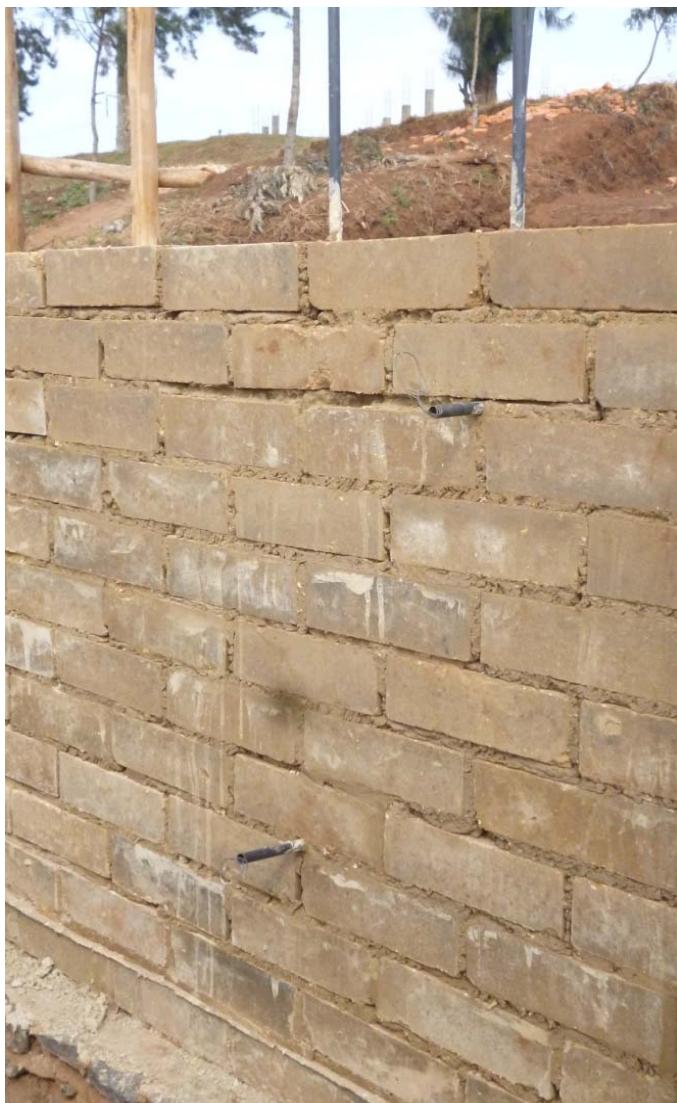


- Settling joints are made under each window.

Ongoing Process : **Buttresses**



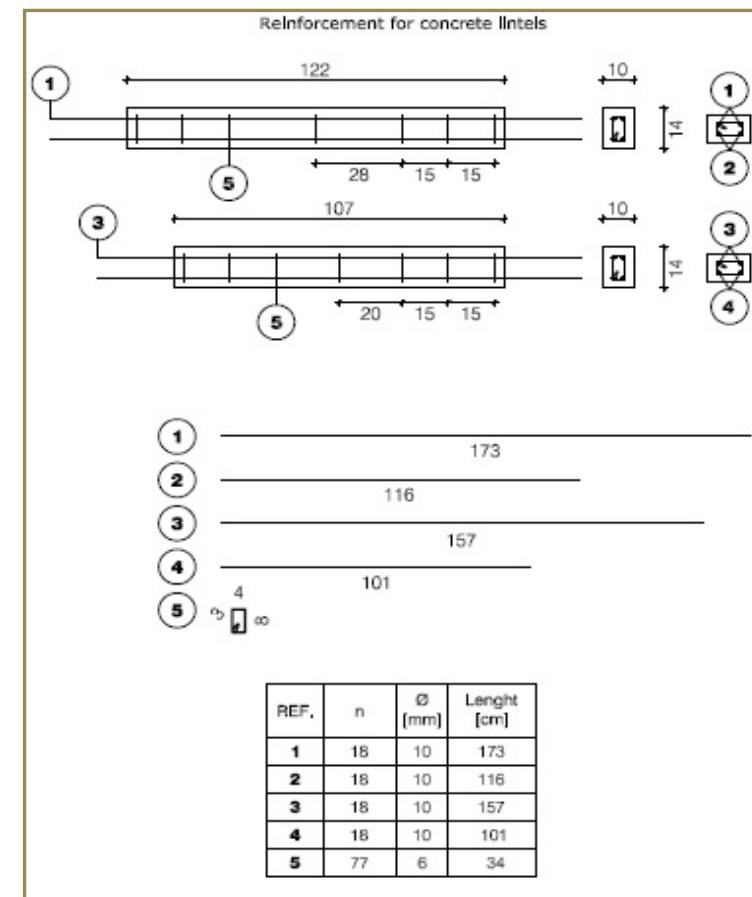
Since the walls are just 14 cm thick buttresses are essentials to ensure their stability.



Ongoing Process : **Wiring**

Wiring has been implemented during masonry works. Lines pass through hollow blocs.

## Ongoing Process : Precast Concrete Lintels

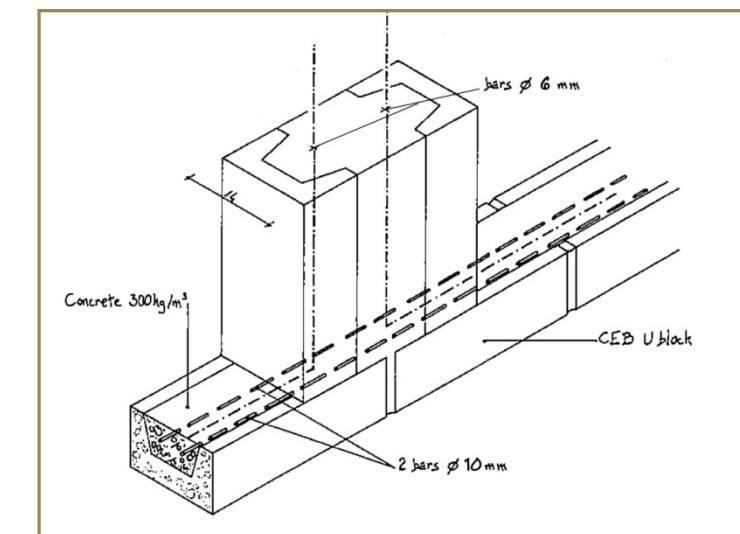


Concrete lintels have been prefabricated about five weeks before to be laid on. Due to an unforeseen, some of them had to be implemented directly on the wall (see picture on the left).

## Ongoing Process : Roof Anchoring

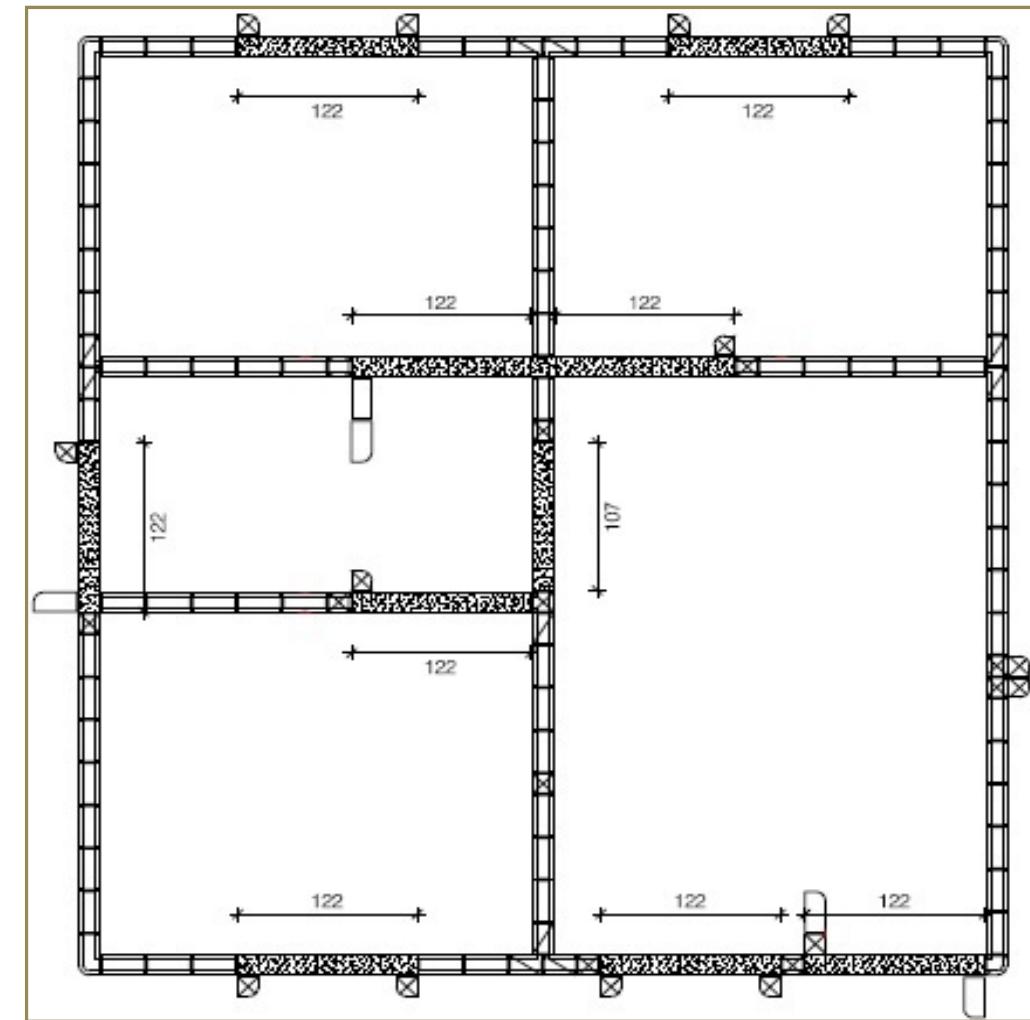


The bearing structure is tied by mean of two Ø6mm iron bars for each anchor point. These steel bars stay under the ring steel bars to guarantee a strong link.



## Ongoing Process : **Upper Ring Beam**

The upper ring beam is made with U blocks filled with reinforced concrete (300kg/m<sup>3</sup>).



## Ongoing Process : Trusses

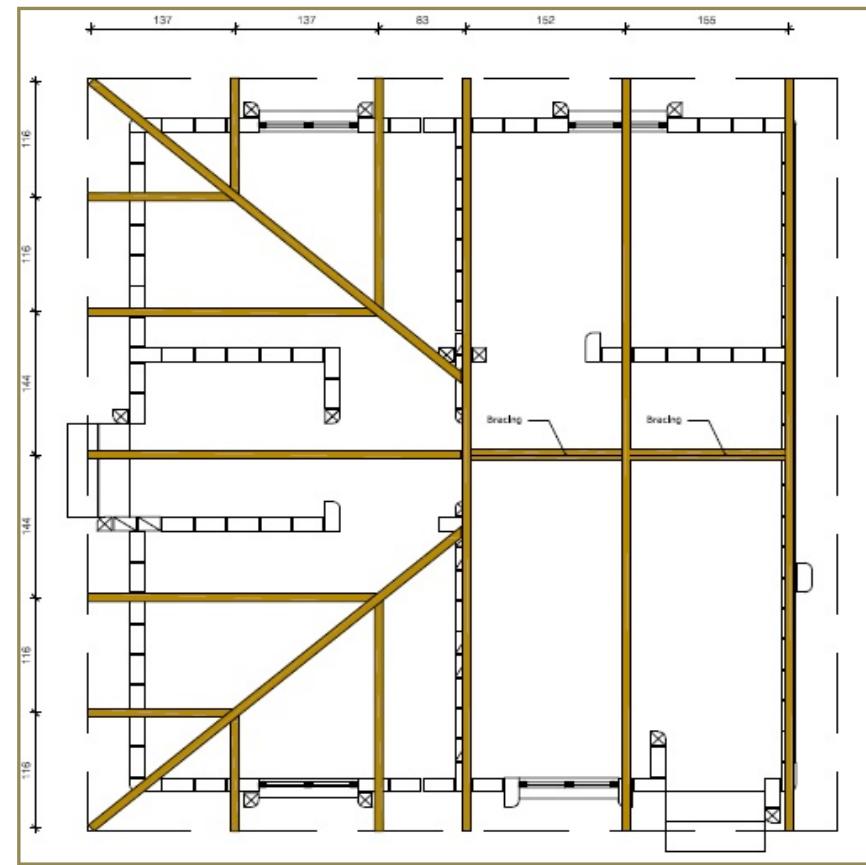


The load bearing structure is composed by five trusses and 6 half trusses making a four slopes roof. To get the openings on the top of the roof, the trusses are  $30^{\circ}$  sloped instead of the half trusses that are  $25^{\circ}$  sloped.

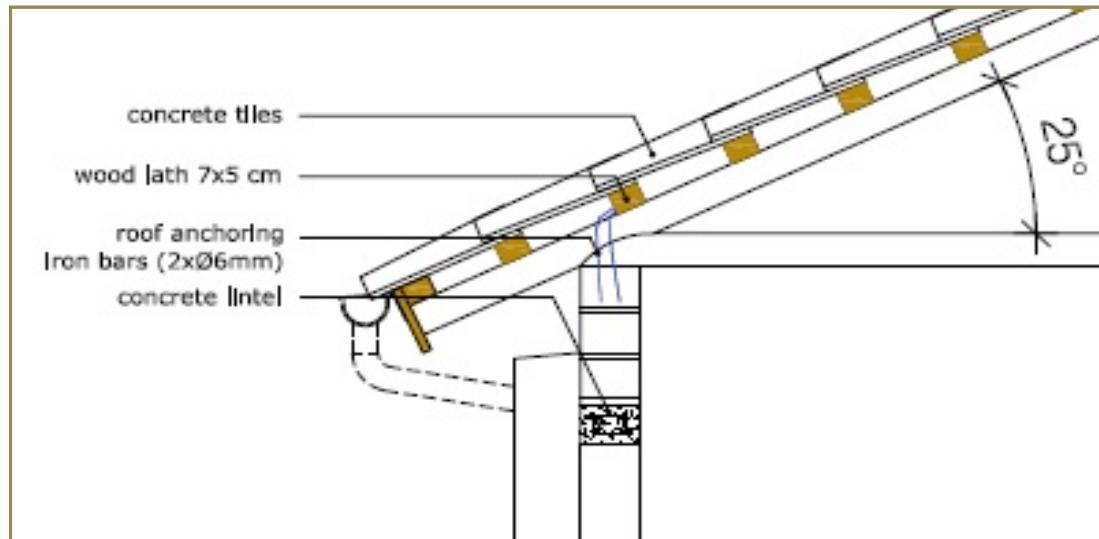




## Ongoing Process : Load Bearing Structure



The load bearing structure is composed by three trusses and three half trusses making a three slopes roof. To get the opening on the top the trusses are  $30^\circ$  sloped instead of the half trusses that are  $25^\circ$  sloped.



## Ongoing Process : Purlins

Some images and details about roof implementation.





## Ongoing Process : Doors and Windows

Doors and windows have been produced by a workshop nearby the site.



### Ongoing Process : False Ceiling

False ceilings have been implemented in all the buildings.



Ongoing Process : **External Finishing**

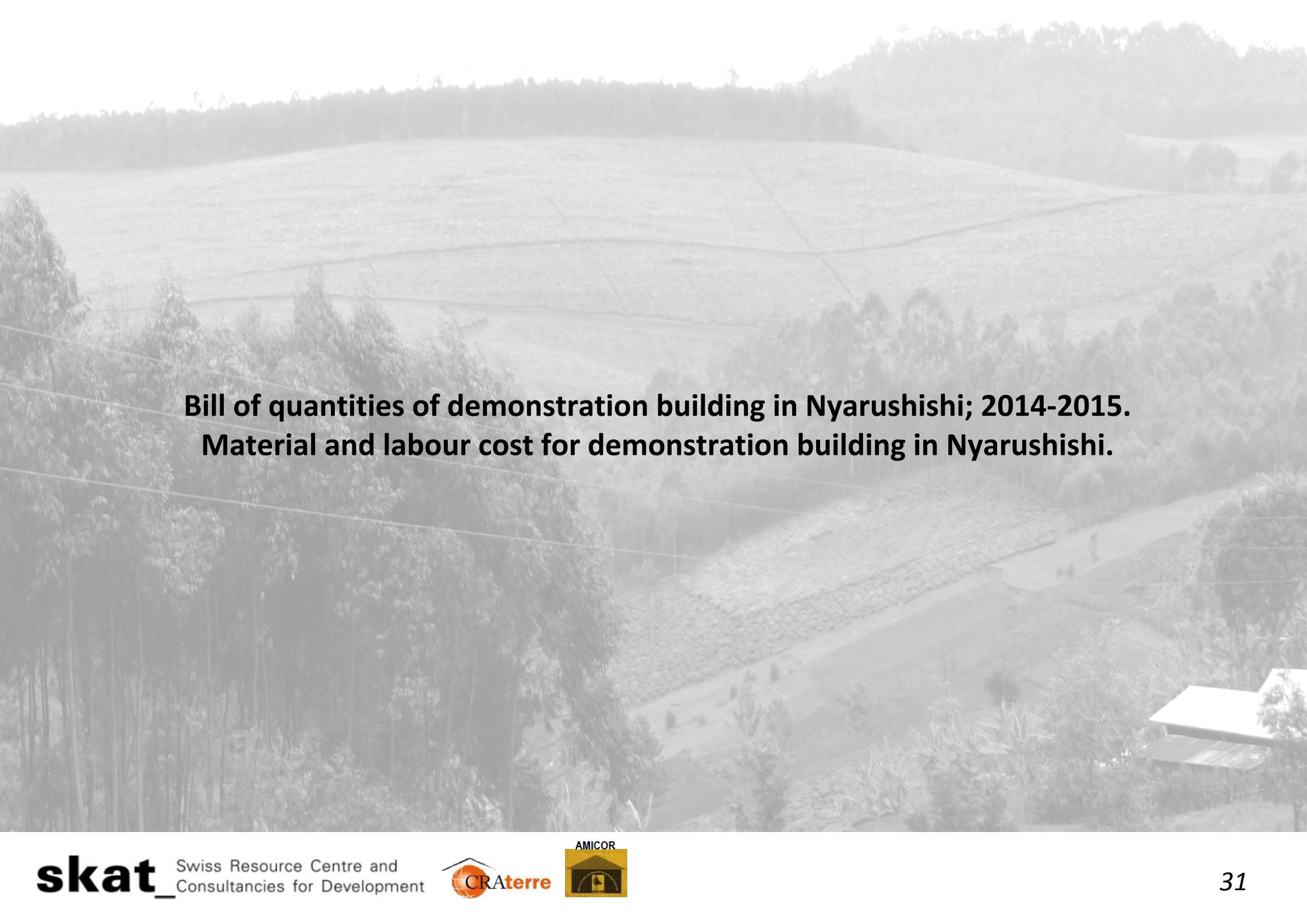


Since SCEB walls are not plastered, a smooth and good looking masonry work is mandatory. Verticality and horizontality of the blocks must be carefully and constantly checked during wall implementation.

## Cost of material and labour in Nyarushishi in 2014 2015.



Designation	Unit	Unit cost including transport to the site
<b>Labour</b>		
Unskilled labour	Day	1.500,00 RWF
Masson	Day	3.000,00 RWF
Carpenters	Day	4.500,00 RWF
Foreman	Day	5.600,00 RWF
<b>Minerals</b>		
Stone Mwezi	m3	13.750,00 RWF
Gravel	m3	21.250,00 RWF
Sand Nyamagama	m3	13.750,00 RWF
SCEB soil Kyazo	m3	23.750,00 RWF
<b>Prefabs material</b>		
Ventilation	Unit	800,00 RWF
Clay roofing tiles	Unit	130,00 RWF
Fired bricks	Unit	40,00 RWF
Stabilized adobe 20x30x10	Unit	75,00 RWF
SCEB 100x140x295	Unit	355,00 RWF
Adobe 20x30x10	Unit	50,00 RWF
<b>Blender</b>		
Lime	40 kg	3.400,00 RWF
Cement	sac	10.000,00 RWF
Water	m3	2.500,00 RWF
<b>Metal</b>		
Metal strip	1,2 m	100,00 RWF
Nails	kg	1.200,00 RWF
Steel bar 6 mm	12 m	2.500,00 RWF
Steel bar 12 mm	12 m	5.400,00 RWF
Wire 1 mm	kg	1.400,00 RWF
<b>Wood</b>		
Plank 170*50*360	Unit	2.600,00 RWF
Plank 170*20*360	Unit	1.500,00 RWF
Plank 50*50*360	Unit	900,00 RWF
Local mat for ceiling (1,2*2 m)	Unit	1.400,00 RWF
Local poles (wood)	4m	1.400,00 RWF
<b>Carpentry</b>		
Outside door (0,9 * 2,1 m) including all hardware	Unit	51.000,00 RWF
Inside door (0,9 * 2,1 m) including all hardware	Unit	41.000,00 RWF
Windows (1,17*0,95 m)	Unit	41.000,00 RWF
Windows (1,20*0,90 m)	Unit	41.000,00 RWF
<b>Others</b>		
Dead oil	20l	6.000,00 RWF
Oil paint	4 litre	9.500,00 RWF
Water paint	20 litre	17.500,00 RWF
Plastic tarpolling	Unit	6.500,00 RWF
PVC pipe for toilet	Lump sum	10.000,00 RWF
Gutter (metal) 1,5 mm	2m	8.000,00 RWF
Hardware for gutter	Lump sum per linear meter	1.000,00 RWF
Water tank 2.000 liter	Unit	290.000,00 RWF
Glass	1 * 1,2 m	10.000,00 RWF
<b>Electricity</b>		
Wire 1,5mm	rolls 100m 1x2,5mm	9.500,00 RWF
PVC pipe 5/8	3 m	400,00 RWF
Switch	Unit	750,00 RWF
Sockets	Unit	550,00 RWF
Lamp	Unit	750,00 RWF
Hardware	Unit	10.600,00 RWF
Electrical board	Unit	3.500,00 RWF



**Bill of quantities of demonstration building in Nyarushishi; 2014-2015.**  
**Material and labour cost for demonstration building in Nyarushishi.**

Items	Unit	Unit cost RWF	Unit cost USD	Quantities	Cost RWF	Cost USD
Site preparation	m <sup>2</sup>	30,00	0,04	167,58	5.027,40	7,34
Excavation	m <sup>3</sup>	1.050,00	1,53	498,60	523.530,00	764,28
Excavation for foundation	ml	315,00	0,46	43,50	13.702,50	20,00
Stone foundation	ml	8.897,00	12,99	43,50	387.019,50	564,99
Stone masonry for bassement	ml	5.356,05	7,82	43,50	232.988,18	340,13
Pole and mud wall	m <sup>2</sup>	3.460,00	5,05	14,60	50.516,00	73,75
SCEB walls	m <sup>2</sup>	13.688,75	19,98	113,10	1.548.197,63	2.260,14
Roof with clay tile	m <sup>2</sup> of living space	10.771,50	15,72	48,18	518.970,87	757,62
Precast RCC lintel	ml	8.741,65	12,76	11,00	96.158,15	140,38
Windows	Unit	36.609,43	53,44	4,00	146.437,72	213,78
Internal door	Unit	51.742,60	75,54	4,00	206.970,40	302,15
External door	Unit	76.242,60	111,30	2,00	152.485,20	222,61
RCC ringbeam cast in SCEB U shaped	ml	4.022,67	5,87	43,50	174.986,15	255,45
Concrete slab	m <sup>2</sup>	6.221,67	9,08	40,80	253.844,00	370,58
Plank finishing on gabble wall	m <sup>2</sup>	3.208,00	4,68	14,60	46.836,80	68,37
Mats Ceiling	m <sup>2</sup>	2.537,25	3,70	40,80	103.519,80	151,12
Plinth	ml	336,15	0,49	57,20	19.227,78	28,07
Well	m <sup>3</sup>	3.930,00	5,74	7,85	30.866,22	45,06
Sink	m <sup>3</sup>	18.130,00	26,47	7,85	142.393,02	207,87
Electricity	Lumpsum	143.650,00	209,71	1,00	143.650,00	209,71
Water storage	Lumpsum	294.500,00	429,93	1,00	294.500,00	429,93
Gutter	ml	6.870,00	10,03	15,20	104.424,00	152,44
Pavement	ml	3.398,33	4,96	27,80	94.473,67	137,92
<b>TOTAL cost (labour and material)</b>					<b>5.290.724,97 RWF</b>	<b>7.723,69 USD</b>
<b>Living space</b>					40,80	40,80
<b>Cost per m<sup>2</sup> of living space</b>					<b>129.674,63 RWF</b>	<b>189,31 USD</b>

Nota 1: Cost is subject to change according to site specificity and inflation.

Nota 2: Cost do not include taxes, margin of contractors, etc...



**Support for cost calculation according to site context  
(cost of material and labour) and technical options.**

Désignation	Unité	Coût unitaire Frw US\$	Quantities	Coût Frw	Coût US\$
Site preparation	m <sup>2</sup>	-	167,58	-	-
Excavation	m <sup>3</sup>	-	according to site context (slope)		
Foundation excavation	ml	-	43,50	-	-
<b>Options: Choose one of the following alternative</b>					
Fired bricks foundation with cement/lime mortar	ml	-	43,50	-	-
Stone foundation with cement/lime mortar	ml	-	43,50	-	-
Stone foundation with earth mortar and cement/lime pointing	ml	-	43,50	-	-
<b>Options: Choose one of the following alternative</b>					
Fired bricks foundation with cement/lime mortar	ml	-	43,50	-	-
Stone foundation with cement/lime mortar	ml	-	43,50	-	-
Fired brick foundation with earth mortar and cement/lime pointing	ml	-	43,50	-	-
Stone foundation with earth mortar and cement/lime pointing	ml	-	43,50	-	-
Adobe walls	m <sup>2</sup>		113,10		
<b>Options: Choose one of the following alternative</b>	m <sup>2</sup>	-			
Corner reinforcement with Fired brick	m <sup>2</sup>	-	1,30	-	-
Corner reinforcement with stabilised adobe	m <sup>2</sup>	-	1,30	-	-
Horizontal Fired Brick masonry layer	ml	-	43,50	-	-
<b>Options: Choose one of the following alternative</b>					
Fired clay tile roof	m <sup>2</sup> living space	-	48,18	-	-
<b>Options: Choose one of the following alternative</b>					
Lintel with wooden planck 5*7	ml	-	11,00	-	-
Lintel with wooden planck 2,5*7 plus fired brick arche	ml	-	11,00	-	-
Lintel with wooden planck 2,5*7 plus adobe arche	ml	-	11,00	-	-
RCC precast lintel	ml	-	11,00	-	-
<b>Options: Choose one of the following alternative</b>					
Windows	unité	-	4,00	-	-
Windows plus wall reinforcement with fired clay bricks	unité	-	4,00	-	-
Internal door	unité	-	4,00	-	-
<b>Options: Choose one of the following alternative</b>					
External door	unité	-	2,00	-	-
External door plus wall reinforcement with fired clay bricks	unité	-	2,00	-	-
<b>Options: Choose one of the following alternative</b>					
Wooden ring beam with planck 5*7	ml	-	43,50	-	-
RCC ring beam	ml	-	43,50	-	-
Concrete slab	m <sup>2</sup>	-	40,80	-	-
Internal plaster	m <sup>2</sup>	-	176,44	-	-
External plaster	m <sup>2</sup>	-	83,28	-	-

Options: Choose one of the following alternative

Ceiling out of plywood	m <sup>2</sup>	-	40,80	-	-
Ceiling out of local mats	m <sup>2</sup>	-	40,80	-	-
Plinth	ml	-	57,20	-	-
Well	m <sup>3</sup>	-	7,85	-	-
Sink	m <sup>3</sup>	-	7,85	-	-
Electricity	Forfait	-	1,00	-	-
Water storage	Forfait	-	1,00	-	-
Gutters	ml	-	15,20	-	-
Pavement	ml	-	27,80	-	-
Other					
<b>TOTAL cost (labour and material)</b>				-	-
<b>Living space</b>				40,80	40,80
<b>Cost per m<sup>2</sup> of living space</b>				-	-